Research Report No. 79/57-19

EVALUATION OF DIMENSION LUMBER MADE FROM DEAD TREES

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May 1979

Roy F. Pellerin

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Washington State University

Pullman, Washington

EVALUATION OF DIMENSION LUMBER MADE FROM DEAD TREES

Final Report

to

U.S. Forest Service
Intermountain Forest & Range Experiment Station
Ogden, Utah 84401

May 1979

by

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EVALUATION OF DIMENSION LUMBER MADE FROM DEAD TREES

INTRODUCTION

The Inland Empire area contains an abundant supply of dead trees, the result of current and past insect and disease epidemics. Some of these trees are being harvested as a component of ongoing timber sales and the logs are mixed with the green logs for processing. Accordingly the lumber from the dead trees is mixed with green tree lumber for sale and use. As more and more of these trees are utilized, information is needed as to the effect of the exposure conditions on the mechanical properties of the lumber cut from these trees.

Since lumber is used normally for construction where strength properties are often of primary consideration, the effect of death, subsequent exposure and utilization on the mechanical properties of dead tree lumber is an urgent need. Nondestructive testing methods have been developed at Washington State University and have been used to evaluate log and lumber quality (1,5). The results of these studies verify that the procedure successfully measures modulus of elasticity from which corresponding values of modulus of rupture can be assigned.

OBJECTIVES

The objectives of this study are: to obtain nondestructive test data for dimension lumber from dead trees of two species, lodgepole pine and western white pine; to test to failure or a sample of the study lumber; to establish the relationship between nondestructive and destructive test values and to compare the results obtained from the dead tree lumber with similar data obtained in previous studies on green tree dimension lumber.

PROCEDURE

Dimension lumber from two species, lodgepole pine and western white pine, was used in the study. The lodgepole pine was obtained from a cooperating sawmill in Montana an the western white pine from a sawmill in Idaho.

The mills were requested to segregate a representative sample of logs obtained from trees that have been dead for various intervals of time. The sample logs were sawn consecutively in a short mill run. The logs were also processed through the mill in accordance with the mill's standard procedure, however, the production of 2 by 4's and 2 by 6's, 10, 12 and 14 feet long were favored. The lodgepole pine dimension lumber cut from the sample logs was segregated at the green chain and set aside for shipment to Washington State University. The western white pine dimension lumber was kiln dried, surfaced, visually graded and segregated so that approximately equal numbers of each grade were obtained for the study. A breakdown of lumber grade, size and quantity is shown in Table I.

Table I. Description of Lumber Selected for Analysis.

Species	Size	Length	Number
Lodgepole pine	2 x 4	8 ft	3
		10 ft	20
		12 ft	40
		14 ft	27
		16 ft	20
	2 x 6	10 ft	8
		12 ft	12
		14 ft	10
		16 ft	8
White pine	2 x 4	8 ft	4
		10 ft	18
		12 ft	47
		14 ft	57
		16 ft	112

Upon receipt at Washington State University the lodgepole pine lumber was stickered, air-dried and surfaced prior to subsequent testing. The western white pine, having already been kiln dried and surfaced, was stickered and allowed to reach equilibrium prior to further testing.

A recent study by Lowery and Hearst (3) indicated that the average moisture content of lodgepole pine lumber from dead trees is approximately 16.5 percent and for western white pine the average is approximately 24 percent. The moisture content of the study lumber at the time of testing was 6 to 7 percent.

After conditioning, each board was nondestructively evaluated with both the E-Computer and the stress wave equipment. Both of these nondestructive methods were developed at Washington State University.

The E-Computer computes the modulus of elasticity of a board from its resonant frequency while supported near its ends. The longitudinal stress wave method determines the modulus of elasticity of a board from the velocity of propagation of a stress wave passing longitudinally through the board and the density of the board.

After nondestructive evaluation, each board was tested on edge to failure in flexure according to ASTM D-198 standards.

RESULTS AND DISCUSSION

Lodgepole Pine

The data obtained from each lodgepole pine specimen is recorded in Appendix A. Besides the values for nondestructive and static properties the data includes dimensions, weight, moisture content at time of test, and the visual grade for each specimen. Table II contains a summary of the regression analysis for each size and combination of properties for the lodgepole pine specimens.

Table II. Analysis of Data for Lodgepole Pine

Size	Abscissa	Ordinate	Number of Specimens	Regression Equation	Correlation Coefficient	Correlation of Determination
2 x 6	E-Computer	E-Stress wave	38	E-stress wave = -0.038 + 1.237 E-computer	0.95	0.90
	E-Computer	E-Static	38	E-static = -0.036 + 0.976 E-computer	0.87	0.76
	E-Computer	MOR	38	MOR = -632.9 + 4067 E-computer	0.68	0.46
	E-Stress wave	E-Static	38	E-Static = 0.059 + 0.75 E-stress wave	0.87	0.76
	E-Stress wave	MOR	38	MOR = -578.4 + 3328.9 E-stress wave	0.73	0.53
2 x 4	E-Computer	E-Stress wave	110	E-stress wave = 0.132 + 1.106 E-computer	0.94	0.88
	E-Computer	E-Static	110	E-static = -0.130 + 1.068 E-computer	0.87	0.76
	E-Computer	MOR	110	MOR = -2597.1 + 6174.65 E-computer	0.71	0.51
	E-Stress wave	E-Static	110	E-static = -0.093 + 0.860 E-stress wave	0.83	0.69
	E-Stress wave	MOR	110	MOR = -2158.2 + 4829.586 E-stress wave	0.66	0.43

Western White Pine

The data obtained from each western white pine specimen is recorded in Appendix B. Besides the values for nondestructive and static properties the data includes dimensions, weight, moisture content at time of test, and the visual grade for each specimen. Table III contains a summary of the regression analysis for each combination of properties for the western white pine specimens.

Green Tree Lumber

Data obtained from previous studies on green tree lumber was used for comparison purposes with the dead tree lumber studied in this research. Table III contains a summary of the regression analysis for each combination of properties for green tree lumber. Previous studies, of course, were not conducted exactly like this study. Therefore, Table IV is made up of more than one study.

The 2 x 8 and 2 x 6 green tree lumber has been extracted from reports by G. G. Marra, et al (4) and R. F. Pellerin (6). The 2 x 4 green tree lumber has been extracted from a study by R. J. Hoyle (2) on 1.5E 1650 f MSR graded hem-fir.

Past experience in research on nondestructive testing of wood shows us that variation due to species is minimal.

Graphs of the regression lines of the various species, sizes, and soundness of lumber for E-computer versus E-static and E-computer versus E-stress wave are presented in Figures I and II respectively.

In Figure I, the regression lines for the 2 x 4 and 2 x 6 dead lodgepole pine groups well with the 2 x 6 green lumber regression line and line for the 2 x 4 dead white pine corresponds well with that for the 2 x 4

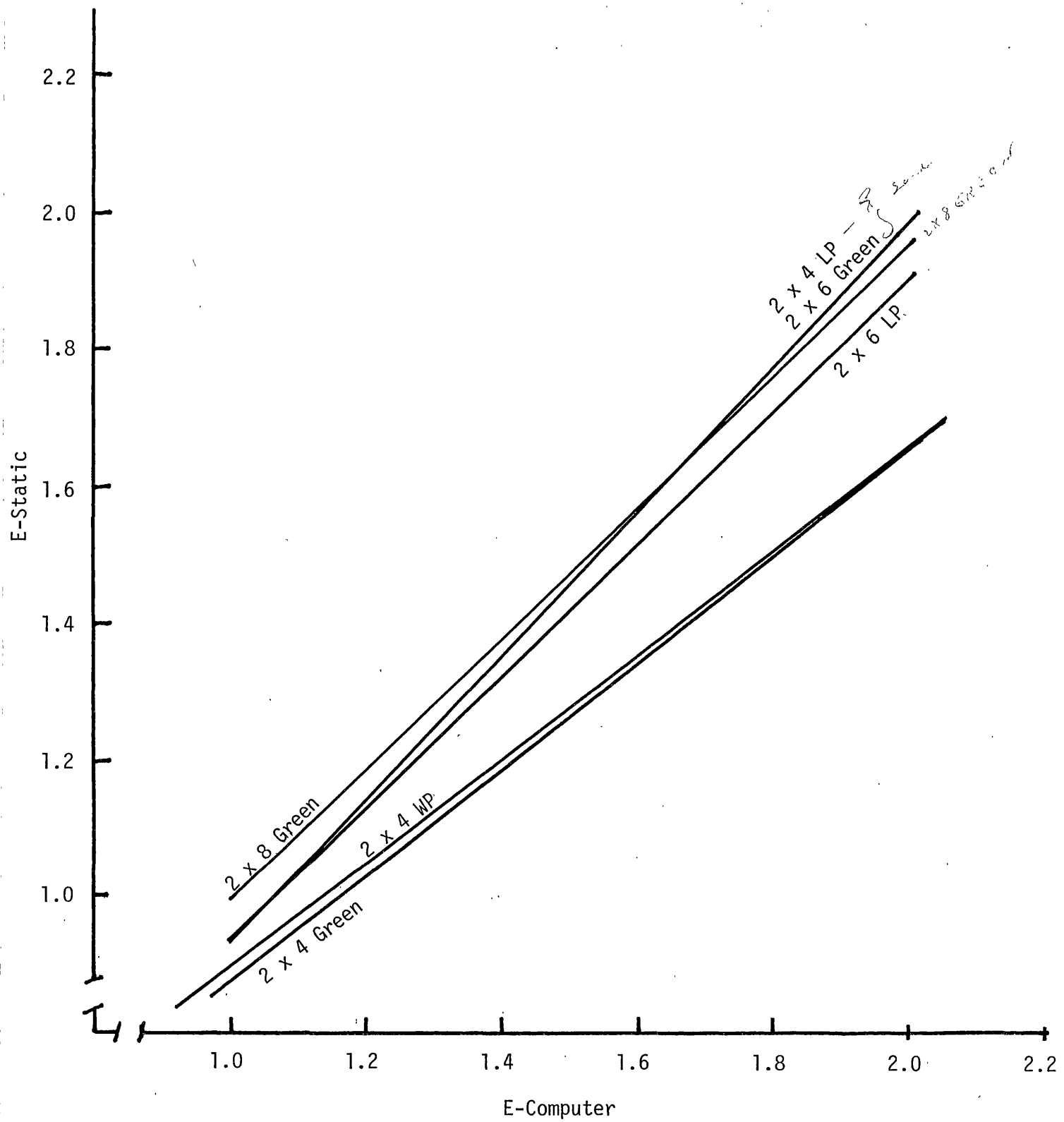
2.2
2.0
1.8
1.6
1.4
1.2
1.0
E-Static
2 x 4 LP
2 x 6 Green
2 x 6 LP
2 x 8 Green
2 x 4 WP
2 x 4 Green
1.0
1.2
1.4
1.6
1.8
2.0
2.2
E-Computer

Figure I.

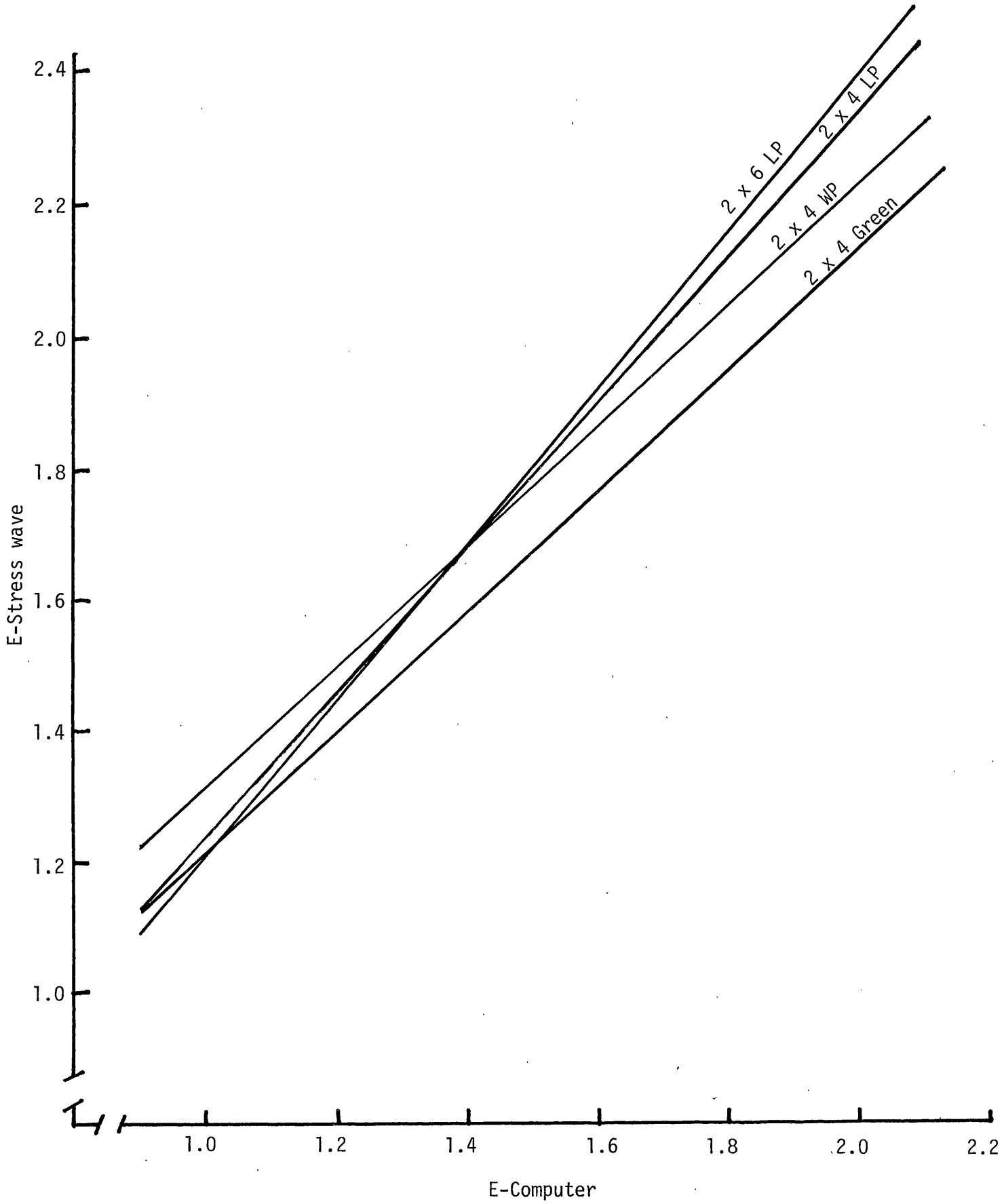
2 x 6 LP
2 x 4 LP
2 x 4 WP
2 x 4 Green
E-Stress wave
E-Computer
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
1.0
1.2
1.4
1.6
1.8
2.0
2.2

Figure II.

Table III. Analysis of Data for Western White Pine.

Size	Abscissa	Ordinate	Number of Specimens	Regression Equation	Correlation Coefficient	Coefficient of Determination
2 x 4	E-Computer	E-Stress wave	238	E-stress wave = 0.417 + 0.906 E-computer	0.90	0.81
	E-Computer	E-Static	238	E-static = 0.148 + 0.756 E-computer	0.80	0.64
	E-Computer	MOR	238	MOR = -1063.2 + 3659.4 E-computer	0.57	0.32
	E-Stress wave	E-Static	238	E-static = 0.015 + 0.717 E-stress wave	0.76	0.58
	E-Stress wave	MOR	238	MOR = -614.1 + 2860.322 E-stress wave	0.45	0.20

Table IV. Analysis of Data for Green Tree Lumber.

Size	Abscissa	Ordinate	Number of Specimens	Regression Equation	Correlation Coefficient	Coefficient of Determination
2 x 8	E-Computer	E-Static	44	E-static = 0.036 + 0.964 E-computer	0.98	0.96
	MOR	E-Computer	24	MOR = -4,440 + 5560 E-computer	0.89	0.79
2 x 6	E-Stress wave	E-static	40	E-static = -0.105 + 1.046 E-stress wave	0.95	0.90
	E-Computer	E-Stress wave	40	E-stress wave = 0.074 + 0.969 E-computer	0.97	0.93
2 x 4	E-Computer	E-Stress wave	107	E-stress wave = 0.250 + 0.94 E-computer	0.91	0.83
	E-Computer	E-Static	107	E-static = 0.110 + 0.773 E-computer	0.79	0.62
	E-Static	MOR	107	MOR = 2416 + 2815 E-static	0.41	0.17

green wood lumber. Whereas in Figure II the regression lines for the dead wood lumber corresponds well with one another also with that for the 2x4 green wood lumber.

Several of the correlation coefficients reported in Tables II, III, and IV are lower than normally reported. This is due to the truncation of the samples of lumber reported.

CONCLUSIONS

From the data reported, it has been concluded that the nondestructive testing methods used would grade lumber that has been cut from dead lodgepole and white pine as efficiently as lumber cut from green trees.

LITERATURE CITED

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Appendix A

Data on Lumber Cut From Dead Lodgepole Pine Trees

SPEC NO	LEN (IN.)	WIDTH (IN.)	TH (IN.)	WT. (LB)	DEN. LB/CUIN	M.C. (%)	E C	TIME M.SEC.	E SW	LOAD LB	MOR PSI	DEFL (IN)	MOE 10**6 PSI	VISUAL GRADE
*******	****	*****	****	****	*******	****	*****	*****	*****	****	****	****	*****	*******
L 1	121.5	6.00	1.73	20.00	0.01586	7.00	1.40	569.	1.80	3500.	6491.	0.364	1.21	
L 2	122.9	6.00	1.73	23.50	0.01842	7.40	2.01	529.	2.41	4250.	7882.	0.215	2.04	
L 3	122.7	6.00	1.74	20.00	0.01561	7.40	1.18	639.	1.40	2900.	5347.	0.391	1.12	
L 4	123.0	5.94	1.72	21.00	0.01671	7.70	1.60	555.	1.99	3525.	6709.	0.321	1.42	
L 5	122.7	6.00	1.71	22.50	0.01787	7.70	1.76	551.	2.16	3875.	7270.	0.291	1.53	
L 6	122.7	6.00	1.71	21.30	0.01692	7.70	1.58	555.	2.02	3930.	7374.	0.264	1.69	
L 7	123.1	6.87	1.73	21.00	0.01435	7.50	1.21	640.	1.29	3210.	4541.	0.300	0.98	
L 8	122.9	6.00	1.75	21.00	0.01627	7.30	1.24	635.	1.48	1673.	3067.	0.436	0.99	
L 9	146.6	6.00	1.75	27.00	0.01754	8.00	1.25	770.	1.57	2275.	4171.	0.355	1.22	
L 10	143.8	6.00	1.72	26.50	0.01786	8.10	1.43	708.	1.89	4055.	7564.	0.282	1.57	
L 11	146.7	6.00	1.76	27.50	0.01775	8.20	1.77	670.	2.09	2645.	4822.	0.255	1.70	
L 12	147.2	6.12	1.69	24.50	0.01609	7.60	1.17	769.	1.44	1815.	3312.	0.339	1.25	
L 13	146.8	6.00	1.70	30.00	0.02004	8.30	1.98	648.	2.53	4320.	8153.	0.182	2.46	
L 14	146.7	6.13	1.71	27.00	0.01756	7.50	1.48	716.	1.81	4000.	7190.	0.230	1.81	
L 15	145.7	5.94	1.71	30.00	0.02027	8.30	2.04	635.	2.66	3956.	7573.	0.242	1.89	
L 16	147.1	6.06	1.72	24.50	0.01598	8.00	1.21	786.	1.37	2165.	3959.	0.339	1.26	
L 17	147.0	6.06	1.72	22.00	0.01436	7.90	0.92	840.	1.08	2630.	4809.	0.394	1.09	
L 18	147.1	6.06	1.71	24.50	0.01607	8.10	1.22	775.	1.42	2310.	4249.	0.348	1.24	
L 19	147.0	6.12	1.74	24.50	0.01565	7.90	1.00	843.	1.17	1328.	2354.	0.539	0.76	
L 20	146.8	5.00	1.73	21.00	0.01654	7.90	1.10	742.	1.59	2425.	6476.	0.558	1.36	
L 21	170.9	6.00	1.73	31.00	0.01748	7.90	1.50	822.	1.87	3030.	5619.	0.282	1.56	
L 22	170.7	6.18	1.73	28.00	0.01534	7.80	1.00	996.	1.12	1120.	1958.	0.479	0.84	
L 23	170.8	6.17	1.72	34.50	0.01903	8.20	1.72	818.	2.06	4675.	8246.	0.264	1.54	
L 24	170.7	6.13	1.73	30.00	0.01657	7.90	1.55	814.	1.81	2950.	5241.	0.315	1.31	
L 25	170.9	6.13	1.73	26.50	0.01462	7.80	0.97	950.	1.17	1030.	1830.	0.500	0.82	
L 26	171.0	6.06	1.74	31.00	0.01719	7.30	1.55	836.	1.78	1680.	3037.	0.327	1.29	
L 27	170.8	6.06	1.71	32.00	0.01808	7.50	1.09	985.	1.35	1995.	3669.	0.455	0.95	
L 28	170.6	6.13	1.72	28.00	0.01557	7.40	0.92	992.	1.14	2115.	3780.	0.430	0.96	
L 29	170.8	6.00	1.71	29.00	0.01655	7.80	1.43	822.	1.77	1620.	3039.	0.391	1.14	
L 30	170.8	6.13	1.74	28.00	0.01537	7.50	0.91	1066.	0.98	1712.	3024.	0.436	0.94	
L 31	195.1	6.06	1.70	37.50	0.01866	7.70	1.83	928.	2.05	1650.	3053.	0.255	1.70	
L 32	195.1	6.25	1.74	36.00	0.01697	7.80	1.35	1041.	1.48	3000.	5098.	0.318	1.21	
L 33	194.8	6.00	1.71	39.30	0.01966	7.50	1.41	915.	2.22	3100.	5816.	0.364	1.22	
L 34	194.6	6.00	1.70	33.00	0.01663	7.00	0.92	1227.	1.04	1520.	2869.	0.573	0.78	
L 35	195.1	6.13	1.73	32.50	0.01571	7.70	1.47	969.	1.58	4115.	7311.	0.294	1.40	
L 36	195.1	6.00	1.74	32.50	0.01596	7.30	1.11	1068.	1.32	1782.	3286.	0.421	1.04	
L 37	194.9	6.06	1.70	37.50	0.01868	7.70	1.25	1083.	1.50	1158.	2142.	0.412	1.05	
L 38	194.2	5.94	1.72	37.50	0.01890	7.40	1.95	921.	2.11	3725.	7089.	0.294	1.55	

******* THE FOLLOWING PRINT OUT GIVES REGRESSION LINE AND PLOTTING FOR E-STRESS WAVE(Y) VS. E-COMPUTER(

REGRESSION LINE IS E-SW= -0.038+ 1.237* (E-COMPUTER)

COEFFICIENT OF DETERMINATION= 0.90

SPEC NO	LEN (IN.)	WIDTH (IN.)	TH (IN.)	WT. (LB)	DEN. LB/CUIN	M.C. (%)	E C	TIME M.SEC.	E SW	LOAD LB	MOR PSI	DEFL (IN)	MOE 10**6 PSI	VISUAL GRADE
1	97.1	3.44	1.51	7.50	0.01487	6.90	1.20	490.	1.45	885.	3640.	0.645	1.07	
2	100.3	3.41	1.49	8.20	0.01609	6.60	1.62	440.	1.94	2050.	8697.	0.409	1.75	
3	98.7	3.45	1.45	8.30	0.01681	7.10	1.46	472.	1.76	1888.	8041.	0.442	1.61	
4	123.1	3.43	1.50	11.30	0.01784	6.70	1.31	655.	1.53	1390.	5789.	0.539	1.30	
5	121.4	3.42	1.49	10.10	0.01633	6.70	1.12	676.	1.31	885.	3732.	0.576	1.23	
6	121.4	3.44	1.50	9.70	0.01548	6.70	0.83	730.	1.07	580.	2402.	0.782	0.89	
7	122.4	3.48	1.47	9.40	0.01501	6.80	1.04	668.	1.23	887.	3662.	0.621	1.10	
8	122.8	3.50	1.50	9.70	0.01505	6.50	1.02	688.	1.17	965.	3860.	0.706	0.93	
9	124.4	3.44	1.49	9.50	0.01490	6.60	1.16	629.	1.38	1318.	5494.	0.627	1.11	
10	122.7	3.45	1.48	10.40	0.01660	6.80	0.95	714.	1.19	985.	4110.	0.712	0.98	
11	123.1	3.44	1.51	10.80	0.01689	6.50	1.73	553.	2.03	1265.	5203.	0.506	1.36	
12	118.9	3.48	1.50	10.40	0.01676	6.00	0.96	686.	1.31	315.	1275.	1.209	0.55	
13	123.1	3.45	1.46	10.80	0.01742	6.10	1.14	647.	1.53	1063.	4496.	0.603	1.17	
14	122.7	3.42	1.49	11.10	0.01775	6.20	1.10	713.	1.28	1000.	4217.	0.670	1.06	
15	123.1	3.44	1.48	10.50	0.01675	6.90	1.69	550.	2.03	1760.	7386.	0.455	1.54	
16	122.8	3.45	1.47	10.00	0.01606	6.30	1.12	667.	1.32	1300.	5461.	0.600	1.17	
17	123.0	3.46	1.50	9.70	0.01519	6.30	1.08	632.	1.40	695.	2845.	0.736	0.92	
18	123.1	3.42	1.47	10.00	0.01616	6.50	1.42	578.	1.77	1405.	6006.	0.527	1.36	
19	122.8	3.51	1.49	9.80	0.01526	6.60	1.28	626.	1.43	1175.	4705.	0.488	1.35	
20	123.1	3.44	1.49	10.70	0.01696	5.90	1.18	642.	1.51	1000.	4169.	0.576	1.21	
21	123.1	3.49	1.50	10.80	0.01676	6.90	1.73	567.	1.91	2350.	9454.	0.406	1.63	
22	123.1	3.41	1.48	11.00	0.01771	6.80	1.77	559.	2.08	1755.	7495.	0.379	1.90	
23	122.8	3.47	1.48	11.00	0.01744	6.60	0.90	689.	1.35	518.	2136.	1.139	0.60	
24	147.1	3.43	1.48	12.50	0.01674	6.30	1.23	755.	1.56	1160.	4897.	0.576	1.23	
25	148.6	3.46	1.49	12.20	0.01592	6.00	1.23	736.	1.56	1440.	5934.	0.509	1.35	
26	143.5	3.46	1.49	13.00	0.01757	7.10	1.72	678.	2.03	1290.	5315.	0.439	1.56	
27	148.5	3.43	1.47	12.00	0.01603	6.70	1.49	695.	1.76	1453.	6175.	0.412	1.73	
28	147.2	3.47	1.49	12.50	0.01642	7.20	1.48	688.	1.84	1924.	7882.	0.403	1.69	
29	146.6	3.49	1.44	12.60	0.01710	7.20	1.48	724.	1.73	1640.	6873.	0.433	1.59	
30	147.0	3.50	1.48	11.00	0.01445	5.90	0.94	828.	1.12	510.	2068.	0.824	0.81	
31	147.0	3.48	1.49	13.30	0.01745	7.00	1.52	751.	1.64	2230.	9083.	0.418	1.61	
32	147.0	3.44	1.50	13.00	0.01714	6.50	1.00	925.	1.06	730.	3023.	0.879	0.79	
33	147.1	3.48	1.44	12.50	0.01696	6.20	1.23	753.	1.58	592.	2495.	0.645	1.08	
34	146.9	3.47	1.47	11.60	0.01548	6.50	0.88	914.	0.98	703.	2919.	0.961	0.72	
35	147.1	3.45	1.49	12.00	0.01587	7.00	1.28	737.	1.55	1345.	5574.	0.552	1.25	
36	146.6	3.45	1.50	12.80	0.01687	6.90	1.56	707.	1.79	1160.	4775.	0.479	1.43	
37	146.5	3.40	1.49	11.00	0.01482	7.10	1.13	766.	1.34	1395.	5953.	0.621	1.16	
38	145.6	3.42	1.48	11.70	0.01588	6.90	1.46	715.	1.65	1180.	5010.	0.512	1.39	
39	146.6	3.48	1.49	12.00	0.01579	6.30	1.24	708.	1.67	940.	3829.	0.897	0.75	
40	146.1	3.45	1.50	11.20	0.01481	6.20	1.00	832.	1.13	575.	2367.	0.721	0.95	
41	146.4	3.46	1.47	13.00	0.01746	6.80	0.99	854.	1.27	1040.	4344.	0.779	0.89	
42	147.2	3.43	1.48	12.60	0.01686	6.70	1.44	738.	1.64	1798.	7590.	0.506	1.40	
43	147.2	3.47	1.45	11.70	0.01580	7.00	1.28	736.	1.54	1305.	5494.	0.479	1.46	
44	146.9	3.48	1.46	11.30	0.01514	6.20	0.93	882.	1.03	880.	3658.	0.791	0.87	
45	147.2	3.41	1.46	12.00	0.01637	6.50	1.49	685.	1.85	975.	4221.	0.521	1.40	
46	147.2	3.45	1.44	13.30	0.01819	7.00	1.54	706.	1.93	2250.	9649.	0.409	1.75	
47	146.7	3.42	1.47	13.20	0.01790	6.30	1.66	662.	2.16	2205.	9426.	0.439	1.64	
48	147.2	3.40	1.46	13.40	0.01834	7.10	1.79	667.	2.18	2195.	9559.	0.394	1.87	
49	147.2	3.41	1.48	12.10	0.01629	6.70	1.43	713.	1.70	1345.	5744.	0.545	1.32	
50	146.0	3.46	1.48	13.20	0.01766	6.50	1.20	802.	1.45	2095.	8691.	0.600	1.15	
51	146.7	3.47	1.45	11.60	0.01572	6.80	0.87	893.	1.04	811.	3414.	0.924	0.76	
52	147.2	3.50	1.49	11.60	0.01511	6.80	1.30	717.	1.56	1196.	4816.	0.509	1.30	
53	147.0	3.43	1.46	11.90	0.01617	6.60	1.08	823.	1.26	803.	3436.	0.700	1.03	
54	147.0	3.43	1.48	12.30	0.01648	6.60	0.97	863.	1.17	254.	1072.	1.448	0.49	

[illegible]	147.2	3.41	1.50	12.50	0.01654	6.80	1.30	705.	1.74	1160.	4888.	0.621	1.14
58	144.2	3.48	1.48	12.00	0.01616	7.00	1.14	730.	1.61	360.	1476.	0.636	1.07
59	147.0	3.47	1.45	12.40	0.01677	6.70	1.03	844.	1.25	534.	2248.	0.752	0.93
60	146.3	3.44	1.44	11.60	0.01601	6.80	0.94	842.	1.20	631.	2722.	0.842	0.86
61	147.2	3.47	1.50	13.60	0.01775	6.90	1.73	667.	2.11	1960.	7976.	0.455	1.48
62	146.7	3.45	1.47	14.40	0.01936	7.00	1.89	678.	2.23	1705.	7162.	0.385	1.82
63	147.1	3.48	1.45	12.50	0.01684	6.60	1.07	798.	1.40	615.	2574.	0.739	0.94
64	172.2	3.43	1.47	15.20	0.01751	6.50	1.02	987.	1.30	992.	4216.	0.664	1.07
65	170.8	3.42	1.48	13.80	0.01596	6.80	1.26	868.	1.53	1720.	7303.	0.561	1.27
66	170.7	3.45	1.48	14.70	0.01687	6.60	1.27	861.	1.64	2125.	8866.	0.652	1.07
67	170.9	3.49	1.51	14.80	0.01643	6.40	1.42	844.	1.67	1320.	5275.	0.527	1.25
68	170.9	3.43	1.47	14.40	0.01671	6.20	1.13	900.	1.49	1210.	5142.	0.621	1.15
69	170.9	3.43	1.46	13.70	0.01601	6.70	1.28	830.	1.68	490.	2097.	0.873	0.82
70	171.0	3.45	1.45	14.00	0.01637	7.00	1.43	807.	1.82	1240.	5281.	0.542	1.31
71	170.8	3.47	1.49	14.50	0.01642	6.90	1.14	928.	1.38	1055.	4322.	0.539	1.26
72	170.8	3.42	1.49	13.90	0.01597	7.20	1.38	820.	1.72	962.	4057.	0.452	1.57
73	170.9	3.40	1.50	14.60	0.01675	7.10	1.43	808.	1.85	1615.	6846.	0.509	1.41
74	171.0	3.51	1.50	14.10	0.01566	7.20	1.34	839.	1.61	1190.	4733.	0.591	1.10
75	170.9	3.46	1.48	15.10	0.01725	7.20	1.55	831.	1.81	2075.	8608.	0.424	1.63
76	170.6	3.47	1.48	13.40	0.01529	6.90	1.10	915.	1.32	1543.	6364.	0.458	1.49
77	170.9	3.45	1.50	14.50	0.01640	6.80	1.61	784.	1.93	2240.	9222.	0.400	1.72
78	170.9	3.45	1.48	13.60	0.01559	7.20	1.21	870.	1.49	1405.	5862.	0.636	1.09
79	169.0	3.43	1.50	13.40	0.01541	7.20	0.75	1133.	0.87	427.	1778.	1.085	0.64
80	170.9	3.40	1.50	13.90	0.01595	6.90	1.30	842.	1.63	1475.	6252.	0.539	1.33
81	170.8	3.52	1.59	13.80	0.01444	7.00	1.33	860.	1.41	1675.	6249.	0.488	1.25
82	164.7	3.43	1.48	15.30	0.01830	7.40	1.76	794.	2.10	1980.	8358.	0.412	1.72
83	169.6	3.46	1.44	14.10	0.01669	6.90	1.37	787.	1.95	933.	3978.	0.479	1.48
84	169.6	3.44	1.48	14.50	0.01679	7.30	1.30	838.	1.73	998.	4188.	0.533	1.32
85	170.7	3.46	1.47	13.50	0.01555	7.00	0.92	998.	1.13	2010.	8395.	0.676	1.03
86	170.7	3.41	1.47	15.40	0.01800	7.10	1.60	806.	2.00	2225.	9567.	0.394	1.84
87	170.7	3.41	1.50	14.50	0.01661	7.00	1.39	824.	1.77	1500.	6321.	0.524	1.36
88	170.7	3.43	1.47	15.80	0.01836	7.30	1.16	915.	1.58	418.	1776.	0.818	0.87
89	170.9	3.43	1.47	15.60	0.01810	7.40	1.61	812.	1.98	2550.	*****	0.409	1.74
90	170.7	3.46	1.55	14.40	0.01573	6.80	1.08	997.	1.14	1375.	5446.	0.606	1.09
91	194.9	3.47	1.45	18.50	0.01887	7.20	1.78	951.	1.97	2250.	9472.	0.403	1.73
92	195.0	3.46	1.49	18.00	0.01791	6.70	1.53	964.	1.82	1720.	7087.	0.503	1.36
93	195.0	3.49	1.48	16.50	0.01638	6.50	1.30	1009.	1.52	1130.	4607.	0.585	1.15
94	193.9	3.47	1.50	14.50	0.01437	6.90	1.02	1118.	1.09	920.	3744.	0.691	0.98
95	195.0	3.45	1.47	16.50	0.01668	7.20	1.33	1001.	1.57	1890.	7940.	0.476	1.47
96	195.1	3.46	1.47	16.50	0.01663	7.30	1.37	998.	1.58	1880.	7852.	0.494	1.41
97	195.0	3.43	1.45	16.00	0.01650	6.80	1.31	995.	1.57	1518.	6540.	0.542	1.33
98	195.0	3.44	1.45	17.50	0.01799	6.40	1.12	1074.	1.47	856.	3667.	0.600	1.19
99	194.9	3.44	1.50	15.50	0.01541	7.20	1.08	1051.	1.32	892.	3694.	0.733	0.94
100	194.9	3.50	1.49	15.50	0.01525	7.10	1.18	1053.	1.30	1776.	7152.	0.503	1.32
101	194.7	3.50	1.50	16.50	0.01614	7.10	0.87	1209.	1.04	480.	1920.	0.961	0.68
102	192.4	3.42	1.44	16.50	0.01741	6.90	1.47	924.	1.93	1410.	6153.	0.473	1.55
103	194.2	3.43	1.50	16.50	0.01651	6.80	1.48	932.	1.80	1675.	6976.	0.458	1.53
104	194.0	3.44	1.49	16.00	0.01609	7.10	1.22	1010.	1.49	850.	3543.	0.585	1.19
105	195.0	3.46	1.49	15.50	0.01542	6.80	1.36	952.	1.61	1425.	5872.	0.512	1.34
106	195.1	3.47	1.50	16.00	0.01576	7.00	1.51	961.	1.61	1600.	6511.	0.430	1.57
107	188.1	3.46	1.44	15.50	0.01654	7.00	1.25	1056.	1.40	1330.	5671.	0.573	1.24
108	195.0	3.50	1.59	17.50	0.01613	6.80	1.90	922.	1.79	1250.	4717.	0.424	1.46
109	195.0	3.41	1.58	16.50	0.01570	7.30	1.57	920.	1.75	1718.	6873.	0.524	1.29
110	194.9	3.46	1.48	16.50	0.01653	7.30	1.50	936.	1.78	1598.	6629.	0.439	1.57

****** THE FOLLOWING PRINT OUT GIVES REGPESSION LINE AND PLOTTING FOR E-STRESS WAVE(Y) VS. E-COMPUTER(X)

EGRESSION LINE IS E-SW= 0.132+ 1.106* (E-COMPUTER)

Appendix B

Data on Lumber Cut From Dead White Pine Trees

[redacted]

SPEC NO	LEN (IN.)	WIDTH (IN.)	TH (IN.)	WT. (LB)	DEN. LB/CUIN	M.C. (%)	E C	TIME M.SEC.	E SW	LOAD LB	MOR PSI	DEFL (IN)	MOE 10**6 PSI	VISUAL GRADE
P 1	96.0	3.47	1.49	6.8	0.01367	6.0	1.62	414.	1.865	1920.	7866.	0.442	1.535	C
P 2	96.0	3.48	1.50	6.8	0.01355	6.0	1.53	424.	1.762	680.	2751.	0.482	1.388	C
P 3	96.0	3.47	1.50	9.0	0.01794	6.0	2.12	405.	2.557	850.	3459.	0.345	1.953	S
P 4	96.0	3.49	1.50	5.4	0.01072	6.0	1.02	465.	1.160	450.	1810.	0.755	0.879	C
P 5	120.0	3.46	1.48	10.0	0.01627	6.0	1.96	503.	2.360	1720.	7135.	0.342	2.014	C
P 6	120.0	3.47	1.50	8.7	0.01393	6.0	1.13	606.	1.391	850.	3459.	0.521	1.295	F
P 7	120.0	3.48	1.49	9.6	0.01543	6.0	1.21	612.	1.511	430.	1752.	0.533	1.263	F
P 8	120.0	3.47	1.50	9.9	0.01585	6.0	1.48	570.	1.789	730.	2971.	0.455	1.484	T
P 9	120.0	3.49	1.50	9.4	0.01496	6.0	1.18	554.	1.789	165.	664.	0.000	0.000	T
P 10	120.0	3.48	1.50	9.1	0.01453	6.0	1.70	522.	1.956	1495.	6049.	0.415	1.611	S
P 11	120.0	3.48	1.49	9.0	0.01446	6.0	1.04	562.	1.680	580.	2362.	0.548	1.228	F
P 12	120.0	3.48	1.51	9.0	0.01427	6.0	1.72	516.	1.966	980.	3939.	0.464	1.433	C
P 13	120.0	3.49	1.51	8.5	0.01344	6.0	1.59	520.	1.824	1280.	5115.	0.424	1.553	T
P 14	120.0	3.49	1.51	8.5	0.01344	6.0	1.05	636.	1.219	715.	2857.	0.627	1.050	T
P 15	120.0	3.47	1.51	10.1	0.01606	6.0	0.56	583.	1.734	480.	1940.	0.618	1.084	F
P 17	120.0	3.49	1.50	9.1	0.01448	6.0	1.70	510.	2.040	750.	3017.	0.418	1.586	F
P 16	120.0	3.53	1.50	9.4	0.01476	6.0	1.91	796.	2.206	2100.	8258.	0.364	1.762	F
P 18	120.0	3.49	1.51	7.4	0.01170	6.0	1.20	574.	1.303	640.	2558.	0.591	1.115	T
P 19	120.0	3.47	1.50	9.0	0.01440	6.0	1.45	554.	1.722	1495.	6084.	0.739	0.913	S
P 20	120.0	3.46	1.47	9.8	0.01606	6.0	1.71	506.	2.300	583.	2435.	0.512	1.356	F
P 21	120.0	3.46	1.49	8.1	0.01309	6.0	1.49	523.	1.756	1975.	8138.	0.421	1.627	S
P 22	120.0	3.49	1.50	8.7	0.01385	6.0	1.40	543.	1.723	940.	3782.	0.503	1.318	F
P 23	144.0	3.44	1.48	10.5	0.01432	6.0	1.44	638.	1.864	790.	3315.	0.479	1.466	S
P 24	144.0	3.45	1.48	11.3	0.01537	6.0	1.17	614.	2.159	730.	3046.	0.391	1.780	T
P 25	144.0	3.48	1.49	10.8	0.01450	6.0	1.59	631.	1.924	435.	1772.	0.524	1.285	S
P 26	144.0	3.49	1.51	10.7	0.01410	6.0	1.80	620.	1.943	770.	3077.	0.406	1.622	C
P 27	144.0	3.49	1.51	10.4	0.01370	6.0	0.97	729.	1.366	400.	1599.	0.885	0.745	F
P 28	144.0	3.48	1.49	10.8	0.01446	6.0	1.55	645.	1.842	810.	3299.	0.570	1.182	F
P 29	144.0	3.49	1.50	9.6	0.01273	6.0	1.34	646.	1.616	695.	2796.	0.533	1.243	C
P 30	144.0	3.41	1.48	12.8	0.01761	6.0	1.42	696.	1.926	1185.	5061.	0.461	1.564	S
P 31	144.0	3.49	1.50	10.2	0.01353	6.0	1.23	685.	1.527	980.	3942.	0.564	1.177	C
P 32	144.0	3.48	1.50	11.0	0.01463	6.0	1.34	672.	1.717	1110.	4491.	0.497	1.346	T
P 33	144.0	3.47	1.50	10.1	0.01347	6.0	1.25	659.	1.643	730.	2971.	0.561	1.204	T
P 34	144.0	3.48	1.50	13.1	0.01344	6.0	1.86	666.	1.605	845.	3419.	0.403	1.660	S
P 35	144.0	3.46	1.48	11.0	0.01491	6.0	1.63	626.	2.017	1690.	7011.	0.415	1.661	C
P 36	144.0	3.45	1.46	9.4	0.01296	6.0	1.05	711.	1.358	260.	1100.	1.000	0.705	T
P 37	144.0	3.48	1.50	13.0	0.01729	6.0	2.12	620.	2.383	2600.	10520.	0.370	1.809	F
P 38	144.0	3.48	1.49	10.1	0.01350	6.0	1.59	605.	1.958	940.	3829.	0.461	1.462	S
P 39	144.0	3.48	1.50	11.7	0.01556	6.0	1.86	624.	2.117	2000.	8092.	0.352	1.903	C
P 40	144.0	3.48	1.50	9.8	0.01303	6.0	1.32	636.	1.707	555.	2246.	0.412	1.623	S
P 41	144.0	3.48	1.50	10.8	0.01437	6.0	1.76	612.	2.032	2000.	8092.	0.433	1.544	S
P 42	144.0	3.49	1.50	10.0	0.01327	6.0	1.62	619.	1.834	1180.	4747.	0.336	1.972	S
P 43	144.0	3.44	1.47	11.8	0.01620	6.0	1.32	695.	1.777	1819.	7686.	0.415	1.702	S
P 44	144.0	3.48	1.49	11.4	0.01527	6.0	1.65	640.	1.975	1410.	5743.	0.455	1.481	S
P 45	144.0	3.48	1.50	10.1	0.01344	6.0	1.38	670.	1.585	1120.	4532.	0.506	1.322	S
P 46	144.0	3.48	1.50	11.7	0.01556	6.0	2.06	594.	2.329	523.	2116.	0.433	1.544	S
P 47	144.0	3.47	1.50	10.0	0.01334	6.0	1.14	712.	1.394	1240.	5046.	0.561	1.204	T
P 48	144.0	3.47	1.50	11.5	0.01534	6.0	1.75	639.	1.990	1415.	5758.	0.433	1.557	T
P 49	144.0	3.47	1.50	11.6	0.01547	6.0	2.01	688.	1.732	1260.	5128.	0.348	1.936	S
P 50	144.0	3.48	1.51	11.4	0.01506	6.0	1.72	624.	2.049	645.	2592.	0.521	1.275	S
P 51	144.0	3.45	1.48	11.6	0.01577	6.0	1.55	651.	1.972	680.	2837.	0.427	1.628	T
P 52	144.0	3.49	1.50	11.2	0.01486	6.0	1.99	589.	2.268	1305.	5250.	0.364	1.824	F
P 53	144.0	3.49	1.51	11.2	0.01476	6.0	1.66	656.	1.816	1160.	4636.	0.458	1.440	S
P 54	144.0	3.43	1.49	11.2	0.01522	6.0	1.41	690.	1.693	930.	3899.	0.561	1.254	S

P 55	144.0	3.49	1.50	9.0	0.01194	6.0	1.19	671.	1.405	400.	1609.	0.773	0.858	F
P 56	144.0	3.48	1.50	10.5	0.01397	6.0	1.50	663.	1.683	1305.	5280.	0.515	1.298	C
P 57	144.0	3.47	1.49	11.0	0.01477	6.0	1.11	674.	1.723	375.	1536.	0.861	0.789	F
P 58	144.0	3.49	1.51	9.6	0.01265	6.0	1.07	723.	1.282	705.	2817.	0.603	1.092	C
P 59	144.0	3.49	1.50	12.7	0.01685	6.0	2.08	618.	2.337	1410.	5672.	0.324	2.045	S
P 60	144.0	3.50	1.50	10.8	0.01428	6.0	1.66	611.	2.207	165.	660.	0.000	0.000	T
P 61	144.0	3.48	1.50	12.1	0.01609	6.0	1.91	618.	2.233	1130.	4572.	0.445	1.502	C
P 62	144.0	3.47	1.49	11.2	0.01504	6.0	1.64	627.	2.027	465.	1905.	0.670	1.014	T
P 63	144.0	3.49	1.51	11.3	0.01489	6.0	1.76	619.	2.059	860.	3437.	0.467	1.412	S
P 64	144.0	3.47	1.50	9.9	0.01321	6.0	1.50	642.	1.697	330.	1343.	0.776	0.870	F
P 65	144.0	3.48	1.51	11.5	0.01520	6.0	1.57	658.	1.860	915.	3678.	0.521	1.275	T
P 66	144.0	3.42	1.47	11.4	0.01575	6.0	1.73	624.	2.142	620.	2650.	0.736	0.977	S
P 67	144.0	3.46	1.50	10.2	0.01365	6.0	1.41	648.	1.721	1350.	5526.	0.461	1.478	T
P 68	144.0	3.47	1.50	11.6	0.01547	6.0	1.53	649.	1.946	938.	3817.	0.509	1.325	F
P 69	120.0	3.47	1.50	8.9	0.01425	6.0	0.94	653.	1.226	1000.	4069.	0.606	1.113	F
P 70	168.0	3.44	1.48	12.8	0.01497	6.0	0.67	1067.	0.950	860.	3609.	1.076	0.652	T
P 71	168.0	3.49	1.50	13.6	0.01547	6.0	1.53	792.	1.781	1110.	4465.	0.627	1.057	T
P 72	168.0	3.47	1.50	13.3	0.01524	6.0	1.90	713.	2.161	1490.	6064.	0.455	1.484	T
P 73	168.0	3.45	1.50	14.5	0.01667	6.0	1.76	768.	2.043	1110.	4570.	0.455	1.510	T
P 74	168.0	3.47	1.49	11.2	0.01289	6.0	1.19	811.	1.416	742.	3040.	0.715	0.950	S
P 75	168.0	3.48	1.50	13.2	0.01505	6.0	1.53	784.	1.769	1170.	4734.	0.518	1.291	T
P 76	168.0	3.49	1.50	11.8	0.01342	6.0	1.62	703.	1.961	560.	2253.	0.530	1.251	T
P 77	168.0	3.44	1.49	11.2	0.01301	6.0	0.81	885.	1.200	628.	2618.	1.109	0.629	T
P 78	168.0	3.48	1.50	11.9	0.01370	6.0	1.51	724.	1.870	820.	3318.	0.506	1.322	T
P 79	168.0	3.46	1.50	12.9	0.01480	6.0	1.21	802.	1.662	620.	2538.	0.718	0.948	T
P 80	168.0	3.47	1.50	14.5	0.01658	6.0	1.61	788.	1.929	1430.	5819.	0.497	1.358	S
P 81	168.0	3.46	1.49	13.0	0.01501	6.0	1.82	723.	2.074	920.	3791.	0.421	1.627	S
P 82	168.0	3.48	1.50	12.8	0.01495	6.0	1.64	738.	1.936	825.	3338.	0.570	1.174	T
P 83	168.0	3.49	1.50	13.0	0.01478	6.0	1.76	733.	1.988	1846.	7426.	0.445	1.489	S
P 84	168.0	3.47	1.51	12.0	0.01363	6.0	1.13	801.	1.535	390.	1577.	0.876	0.765	S
P 85	168.0	3.49	1.50	11.6	0.01319	6.0	1.58	702.	1.934	1030.	4144.	0.476	1.394	F
P 86	168.0	3.47	1.50	12.0	0.01372	6.0	1.38	785.	1.609	845.	3439.	0.633	1.065	T
P 87	168.0	3.48	1.51	13.9	0.01574	6.0	1.60	766.	1.939	1190.	4783.	0.464	1.433	T
P 88	168.0	3.48	1.50	11.6	0.01323	6.0	1.33	766.	1.629	1550.	6271.	0.591	1.132	S
P 89	168.0	3.47	1.50	15.3	0.01750	6.0	1.75	777.	2.093	2000.	8139.	0.473	1.427	S
P 90	168.0	3.48	1.50	12.3	0.01403	6.0	1.12	863.	1.360	1500.	6069.	0.648	1.031	S
P 91	168.0	3.49	1.50	12.6	0.01436	6.0	1.14	853.	1.422	1205.	4848.	0.573	1.158	F
P 92	168.0	3.46	1.50	16.8	0.01927	6.0	1.95	784.	2.265	2350.	9619.	0.382	1.782	S
P 93	168.0	3.47	1.50	13.4	0.01532	6.0	1.38	860.	1.497	1560.	6348.	0.585	1.154	C
P 94	168.0	3.48	1.49	13.0	0.01492	6.0	1.93	692.	2.251	1190.	4847.	0.436	1.543	S
P 95	168.0	3.48	1.49	12.0	0.01377	6.0	1.13	887.	1.265	580.	2362.	0.691	0.975	F
P 96	168.0	3.48	1.50	11.7	0.01334	6.0	1.56	740.	1.760	994.	4022.	0.515	1.298	F
P 97	168.0	3.47	1.50	11.8	0.01349	6.0	1.40	756.	1.706	900.	3663.	0.542	1.244	S
P 98	168.0	3.46	1.48	10.3	0.01197	6.0	1.28	758.	1.505	1165.	4833.	0.576	1.198	S
P 99	168.0	3.46	1.48	11.5	0.01337	6.0	1.30	810.	1.472	1055.	4376.	0.576	1.198	S
P100	168.0	3.46	1.50	12.8	0.01468	6.0	1.73	723.	2.029	1415.	5792.	0.442	1.538	S
P101	168.0	3.47	1.50	15.4	0.01761	6.0	1.83	770.	2.146	1120.	4558.	0.427	1.579	C
P102	168.0	3.48	1.45	15.0	0.01769	6.0	2.09	711.	2.529	2200.	9208.	0.348	1.986	S
P103	168.0	3.54	1.49	12.4	0.01399	6.0	1.59	732.	1.886	490.	1929.	0.503	1.272	S
P104	168.0	3.47	1.50	15.0	0.01715	6.0	1.22	873.	1.626	597.	2429.	0.621	1.086	S
P105	168.0	3.46	1.50	12.9	0.01479	6.0	1.56	758.	1.860	1755.	7183.	0.506	1.345	C
P106	168.0	3.47	1.49	15.8	0.01819	6.0	2.49	686.	2.793	2210.	9054.	0.318	2.135	S
P107	168.0	3.46	1.49	13.0	0.01501	6.0	1.62	735.	2.000	1265.	5212.	0.436	1.570	S
P108	168.0	3.49	1.50	12.5	0.01421	6.0	1.56	747.	1.840	1390.	5592.	0.461	1.440	C
P109	168.0	3.46	1.49	13.2	0.01524	6.0	1.44	805.	1.700	1518.	6255.	0.500	1.370	S
P110	168.0	3.47	1.49	12.7	0.01462	6.0	1.70	723.	2.021	1060.	4343.	0.485	1.401	S
P111	168.0	3.46	1.48	12.0	0.01395	6.0	1.56	728.	1.901	1465.	6077.	0.515	1.339	S
P112	168.0	3.45	1.49	11.4	0.01320	6.0	1.30	790.	1.528	693.	2872.	0.567	1.220	S
P113	168.0	3.48	1.49	13.3	0.01527	6.0	1.57	745.	1.987	750.	3055.	0.579	1.163	S
P124	168.0	3.46	1.49	12.0	0.01386	6.0	1.68	710.	1.985	1640.	6758.	0.485	1.413	C
P114	168.0	3.46	1.49	14.6	0.01685	6.0	1.45	833.	1.755	1780.	7334.	0.500	1.370	C
P115	168.0	3.48	1.49	14.4	0.01653	6.0	1.95	734.	2.216	1580.	6436.	0.388	1.736	T
P116	168.0	3.45	1.45	11.5	0.01368	6.0	1.18	820.	1.470	815.	3471.	0.621	1.143	S

2118	192.0	3.46	1.50	13.0	0.01491	6.0	1.84	726.	2.043	1630.	6672.	0.455	1.497	S
2119	192.0	3.44	1.48	12.5	0.01473	6.0	1.70	749.	1.897	1950.	8184.	0.433	1.620	S
2120	192.0	3.45	1.49	13.1	0.01517	6.0	2.02	688.	2.315	1582.	6556.	0.406	1.702	S
2121	192.0	3.45	1.48	12.8	0.01468	6.0	1.93	698.	2.206	1350.	5600.	0.424	1.626	S
2122	192.0	3.46	1.48	13.4	0.01558	6.0	1.72	731.	2.106	1795.	7446.	0.427	1.614	S
2123	192.0	3.45	1.49	14.4	0.01663	6.0	2.15	706.	2.410	1860.	7664.	0.370	1.853	S
2125	192.0	3.47	1.49	13.2	0.01520	6.0	1.86	714.	2.153	1485.	6084.	0.482	1.410	S
2126	192.0	3.48	1.49	12.4	0.01433	6.0	1.38	776.	1.719	1075.	4379.	0.597	1.128	S
2127	192.0	3.47	1.49	12.5	0.01259	6.0	1.45	872.	1.565	1705.	6985.	0.524	1.296	S
2128	192.0	3.47	1.49	14.5	0.01461	6.0	1.69	832.	1.994	940.	3851.	0.533	1.274	T
2129	192.0	3.47	1.49	16.0	0.01612	6.0	1.46	916.	1.815	926.	3794.	0.585	1.161	T
2130	192.0	3.45	1.49	13.0	0.01317	6.0	1.07	990.	1.224	557.	2308.	0.812	0.851	T
2131	192.0	3.46	1.48	13.5	0.01373	6.0	2.03	864.	1.738	2150.	8919.	0.482	1.432	T
2132	192.0	3.46	1.49	14.5	0.01465	6.0	1.59	846.	1.934	870.	3585.	0.555	1.236	T
2133	192.0	3.47	1.49	15.0	0.01511	6.0	1.47	873.	1.873	710.	2909.	0.621	1.093	T
2134	192.0	3.47	1.49	14.0	0.01410	6.0	1.76	809.	2.036	960.	3933.	0.491	1.384	T
2135	192.0	3.47	1.49	16.5	0.01662	6.0	1.81	869.	2.079	1675.	6862.	0.400	1.698	T
2136	192.0	3.47	1.49	13.0	0.01309	6.0	1.37	928.	1.437	925.	3790.	0.542	1.252	T
2137	192.0	3.47	1.49	14.5	0.01461	6.0	1.81	813.	2.087	456.	1868.	0.606	1.121	S
2138	192.0	3.48	1.49	15.0	0.01506	6.0	1.83	825.	2.091	775.	3157.	0.494	1.363	S
2139	192.0	3.47	1.48	13.5	0.01369	6.0	1.47	885.	1.651	952.	3926.	0.530	1.290	S
2140	192.0	3.46	1.50	15.5	0.01554	6.0	1.85	843.	2.068	2240.	9168.	0.445	1.528	C
2141	192.0	3.46	1.49	14.0	0.01414	6.0	1.84	795.	2.114	1820.	7499.	0.421	1.627	S
2142	192.0	3.45	1.48	15.0	0.01530	6.0	1.85	832.	2.088	1730.	7218.	0.439	1.584	T
2143	192.0	3.46	1.49	14.0	0.01414	6.0	1.33	921.	1.575	750.	3090.	0.558	1.229	T
2144	192.0	3.46	1.49	15.0	0.01515	6.0	1.69	857.	1.950	943.	3886.	0.615	1.114	T
2145	192.0	3.47	1.49	15.5	0.01561	6.0	1.59	917.	1.754	1158.	4744.	0.579	1.174	T
2146	192.0	3.44	1.49	13.0	0.01321	6.0	0.83	1116.	1.002	365.	1522.	1.030	0.677	T
2147	192.0	3.45	1.49	16.5	0.01672	6.0	1.86	820.	2.349	957.	3966.	0.573	1.207	T
2149	192.0	3.47	1.49	11.5	0.01158	6.0	1.16	925.	1.280	1070.	4384.	0.627	1.083	F
2149	192.0	3.46	1.49	14.0	0.01414	6.0	1.42	875.	1.745	500.	2060.	0.639	1.072	T
2150	192.0	3.47	1.48	15.5	0.01572	6.0	1.79	867.	1.976	1020.	4207.	0.555	1.233	T
2151	192.0	3.41	1.46	14.0	0.01465	6.0	0.92	1100.	1.143	280.	1212.	1.276	0.573	T
2152	192.0	3.48	1.50	14.5	0.01447	6.0	1.62	880.	1.765	762.	3083.	0.606	1.104	T
2153	192.0	3.42	1.49	14.0	0.01431	6.0	1.13	950.	1.498	432.	1822.	0.964	0.736	T
2154	192.0	3.47	1.48	12.5	0.01268	6.0	1.03	929.	1.388	255.	1052.	1.515	0.451	T
2155	192.0	3.47	1.48	13.5	0.01369	6.0	1.55	838.	1.841	712.	2937.	0.594	1.151	S
2156	192.0	3.40	1.46	13.5	0.01416	6.0	0.96	1045.	1.225	582.	2535.	0.848	0.868	T
2157	192.0	3.48	1.49	15.5	0.01552	6.0	1.77	855.	2.006	1095.	4460.	0.494	1.363	S
2158	192.0	3.45	1.48	15.5	0.01581	6.0	1.17	1061.	1.326	580.	2420.	0.821	0.847	T
2159	192.0	3.48	1.50	13.0	0.01297	6.0	1.50	844.	1.721	1330.	5381.	0.552	1.213	S
2160	192.0	3.46	1.48	16.5	0.01678	6.0	2.08	823.	2.342	1520.	6305.	0.427	1.614	T
2161	192.0	3.48	1.50	15.5	0.01547	6.0	1.95	861.	1.970	1250.	5058.	0.442	1.512	T
2162	192.0	3.43	1.57	14.0	0.01354	6.0	0.54	1412.	0.642	620.	2467.	0.927	0.720	T
2163	192.0	3.46	1.49	13.0	0.01257	6.0	1.19	973.	1.254	660.	2720.	0.606	1.130	T
2164	192.0	3.46	1.49	14.0	0.01414	6.0	1.75	834.	1.921	1795.	7396.	0.500	1.370	S
2165	192.0	3.48	1.49	12.5	0.01256	6.0	1.13	953.	1.306	430.	1752.	0.791	0.851	F
2166	192.0	3.46	1.50	16.0	0.01606	6.0	1.80	860.	2.051	1565.	6406.	0.470	1.449	S
2167	192.0	3.45	1.49	14.5	0.01469	6.0	1.05	1037.	1.291	1183.	4903.	0.645	1.071	T
2168	192.0	3.52	1.50	14.0	0.01480	6.0	1.92	830.	2.029	905.	3579.	0.445	1.451	S
2169	192.0	3.47	1.49	17.0	0.01712	6.0	2.01	864.	2.168	1150.	4711.	0.518	1.311	S
2170	192.0	3.49	1.50	12.5	0.01244	6.0	1.19	938.	1.335	1175.	4727.	0.688	0.964	S
2171	192.0	3.49	1.50	14.5	0.01443	6.0	1.01	953.	1.500	350.	1408.	1.145	0.579	F
2172	192.0	3.29	1.47	13.5	0.01454	6.0	1.26	880.	1.774	362.	1672.	0.736	1.097	F
2173	192.0	3.46	1.49	15.0	0.01515	6.0	1.79	843.	2.016	1650.	6799.	0.424	1.615	F
2174	192.0	3.34	1.50	15.0	0.01559	6.0	0.85	1189.	1.043	175.	769.	0.000	0.000	F
2175	192.0	3.47	1.49	15.0	0.01511	6.0	1.30	937.	1.626	950.	3892.	0.624	1.088	F
2176	192.0	3.47	1.49	13.0	0.01309	6.0	1.27	864.	1.657	675.	2765.	0.591	1.149	F
2177	192.0	3.49	1.50	15.0	0.01493	6.0	1.37	957.	1.540	744.	2993.	0.567	1.170	S
2178	192.0	3.49	1.50	14.0	0.01393	6.0	1.26	1046.	1.203	535.	2152.	0.739	0.897	F
2179	192.0	3.50	1.50	13.0	0.01290	6.0	1.50	840.	1.727	695.	2780.	0.588	1.118	F
2180	192.0	3.45	1.50	16.0	0.01610	6.0	1.58	916.	1.814	1368.	5632.	0.579	1.186	S

P182	192.0	3.48	1.49	14.0	0.01406	6.0	1.29	838.	1.892	505.	2057.	0.994	0.878	C
P183	192.0	3.47	1.49	11.5	0.01158	6.0	1.28	856.	1.493	1503.	6157.	0.658	1.033	C
P184	192.0	3.47	1.50	14.0	0.01401	6.0	1.86	812.	2.007	2080.	8464.	0.412	1.637	C
P185	192.0	3.48	1.49	15.0	0.01507	6.0	1.87	834.	2.046	1610.	6558.	0.400	1.683	C
P186	192.0	3.48	1.49	17.0	0.01708	6.0	1.48	913.	1.935	661.	2692.	0.564	1.195	S
P187	192.0	3.48	1.50	14.5	0.01443	6.0	1.69	857.	1.856	1410.	5705.	0.436	1.533	S
P188	192.0	3.49	1.49	14.5	0.01453	6.0	1.23	912.	1.650	446.	1806.	0.624	1.069	F
P189	192.0	3.47	1.49	15.0	0.01511	6.0	1.25	944.	1.602	918.	3761.	0.642	1.057	S
P190	192.0	3.48	1.50	12.0	0.01197	6.0	1.20	898.	1.603	505.	2043.	0.652	1.027	C
P191	192.0	3.48	1.49	14.5	0.01456	6.0	1.66	840.	1.950	1670.	6802.	0.455	1.481	C
P192	192.0	3.47	1.50	14.5	0.01451	6.0	1.56	889.	1.942	1120.	4558.	0.642	1.050	S
P193	192.0	3.47	1.48	13.0	0.01311	6.0	1.42	840.	1.755	820.	3382.	0.585	1.169	F
P194	192.0	3.49	1.50	12.5	0.01244	6.0	1.48	825.	1.726	1135.	4566.	0.564	1.177	C
P195	192.0	3.47	1.51	15.5	0.01541	6.0	1.93	831.	2.108	1730.	6994.	0.406	1.651	C
P196	192.0	3.48	1.50	13.0	0.01297	6.0	1.49	850.	1.696	1825.	7384.	0.497	1.346	C
P197	192.0	3.47	1.48	14.5	0.01470	6.0	1.65	818.	2.077	1550.	6393.	0.482	1.419	C
P198	192.0	3.44	1.48	14.0	0.01432	6.0	1.28	970.	1.438	1040.	4365.	0.633	1.108	S
P199	192.0	3.48	1.49	16.5	0.01657	6.0	2.16	810.	2.387	2475.	10081.	0.373	1.807	C
P200	192.0	3.46	1.49	14.0	0.01456	6.0	1.73	833.	1.926	1640.	6758.	0.476	1.440	C
P201	192.0	3.47	1.49	14.0	0.01456	6.0	1.63	852.	1.842	988.	4048.	0.515	1.319	C
P202	192.0	3.47	1.48	15.5	0.01572	6.0	1.31	966.	1.592	350.	1444.	1.100	0.622	S
P203	192.0	3.45	1.49	13.0	0.01317	6.0	1.14	942.	1.403	880.	3647.	0.682	1.014	S
P204	192.0	3.46	1.50	16.0	0.01606	6.0	1.78	851.	2.094	900.	3684.	0.464	1.468	C
P205	192.0	3.46	1.49	16.0	0.01616	6.0	2.08	810.	2.328	740.	3049.	0.412	1.662	C
P206	192.0	3.46	1.49	16.0	0.01616	6.0	2.07	814.	2.305	1400.	5769.	0.367	1.869	C
P207	192.0	3.47	1.49	14.0	0.01410	6.0	1.73	838.	1.897	2190.	8972.	0.455	1.494	C
P208	192.0	3.46	1.48	14.5	0.01475	6.0	0.98	1018.	1.344	796.	3302.	0.876	0.788	T
P209	192.0	3.47	1.49	15.5	0.01461	6.0	1.76	841.	1.951	1840.	7538.	0.430	1.579	T
P210	192.0	3.49	1.49	14.5	0.01452	6.0	1.54	902.	1.687	1135.	4597.	0.648	1.030	T
P211	192.0	3.47	1.49	16.0	0.01612	6.0	2.00	826.	2.231	1405.	5756.	0.394	1.724	S
P212	192.0	3.48	1.50	14.5	0.01447	6.0	1.75	850.	1.892	1670.	6757.	0.439	1.522	C
P213	192.0	3.48	1.49	13.0	0.01306	6.0	1.29	905.	1.506	750.	3055.	0.642	1.048	T
P214	192.0	3.46	1.49	19.5	0.01970	6.0	1.89	914.	2.228	1260.	5192.	0.445	1.538	S
P215	192.0	3.49	1.50	14.0	0.01393	6.0	1.52	896.	1.640	850.	3420.	0.567	1.170	C
P216	192.0	3.47	1.50	15.0	0.01501	6.0	2.05	810.	2.162	1520.	6186.	0.391	1.726	C
P217	192.0	3.45	1.49	15.5	0.01570	6.0	1.65	901.	1.828	1650.	6838.	0.482	1.434	C
P218	192.0	3.45	1.48	14.0	0.01428	6.0	1.31	1063.	1.194	1420.	5925.	0.491	1.417	C
P219	192.0	3.46	1.49	13.0	0.01313	6.0	1.43	911.	1.495	1400.	5769.	0.624	1.098	C
P220	192.0	3.45	1.48	13.0	0.01326	6.0	1.35	881.	1.613	605.	2524.	0.733	0.949	C
P221	192.0	3.47	1.48	14.5	0.01470	6.0	1.63	870.	1.836	2520.	10394.	0.452	1.515	C
P222	192.0	3.48	1.49	16.0	0.01607	6.0	1.98	826.	2.225	1840.	7495.	0.409	1.646	C
P223	192.0	3.48	1.49	13.5	0.01356	6.0	1.44	865.	1.712	947.	3857.	0.639	1.053	C
P224	192.0	3.50	1.50	14.5	0.01439	6.0	1.25	956.	1.487	1280.	5120.	0.533	1.233	T
P225	192.0	3.45	1.49	13.5	0.01368	6.0	1.21	936.	1.475	652.	2702.	0.673	1.027	T
P226	192.0	3.48	1.49	13.0	0.01306	6.0	1.60	837.	1.761	1863.	7588.	0.512	1.315	S
P227	192.0	3.48	1.49	16.0	0.01607	6.0	2.11	793.	2.415	1357.	5527.	0.433	1.554	S
P228	192.0	3.48	1.48	15.0	0.01517	6.0	2.03	796.	2.261	1340.	5495.	0.370	1.834	S
P229	192.0	3.47	1.49	13.5	0.01360	6.0	1.57	837.	1.833	538.	2204.	0.670	1.014	C
P230	192.0	3.46	1.49	15.0	0.01515	6.0	1.78	852.	1.972	1500.	6181.	0.479	1.431	C
P231	192.0	3.44	1.49	16.0	0.01626	6.0	2.01	837.	2.193	745.	3106.	0.488	1.429	S
P232	192.0	3.47	1.49	15.0	0.01511	6.0	1.89	842.	2.013	1925.	7886.	0.445	1.525	C
P233	192.0	3.45	1.49	14.0	0.01418	6.0	1.55	864.	1.796	650.	2694.	0.606	1.140	S
P234	192.0	3.47	1.49	13.0	0.01309	6.0	1.53	857.	1.685	1930.	7907.	0.518	1.311	C
P235	192.0	3.46	1.48	15.0	0.01526	6.0	1.65	886.	1.837	1230.	5102.	0.521	1.323	C
P236	192.0	3.46	1.48	15.5	0.01576	6.0	1.45	978.	1.558	1735.	7197.	0.548	1.258	C
P237	192.0	3.47	1.49	13.5	0.01360	6.0	1.17	876.	1.674	925.	3790.	0.588	1.155	C
P238	192.0	3.48	1.50	14.5	0.01461	6.0	1.64	895.	1.724	1890.	7647.	0.470	1.424	C
	192.0	3.47	1.50	13.5	0.01351	6.0	1.64	840.	1.809	917.	3732.	0.482	1.400	C

******** THE FOLLOWING PRINT OUT GIVES REGRESSION LINE AND PLOTTING FOR E-STRESS WAVE(Y) VS. E-COMPUTER(